REMARKS

The present Amendment is responsive to the final Office Action mailed April 1, 2008 in the above-identified application.

Claim 13 is canceled without prejudice or disclaimer. New claim 21 is added. Therefore, claims 12 and 14-21 are the claims currently pending in the present application.

Claim 12 is amended to clarify features recited thereby. The amendment to claim 12 and new claim 21 do not add new features to the claims.

Rejection of Claims 12-16 and 18-20 under 35 U.S.C. § 103

Claims 12-16 and 18-20 are rejected under 35 U.S.C. § 103 as being obvious from Cho et al., "Generation of 90-nJ pulses with a 4-MHz repetition-rate Kerr-lens mode-locked Ti:Al_2O_3 laser operating with net positive and negative intracavity dispersion," Opt. Lett. 26, 560-562 (2001) (hereafter "Cho") in view of Szipocs et al., U.S. Patent No. 5,734,503. Reconsideration of this rejection is respectfully requested.

According to an aspect of applicant's invention as claimed in claim 12, an inventive light dispersion managing arrangement is made possible in a substantially broad range of frequencies by a combination of using chirped mirrors (having a negative dispersion) and limiting the average dispersion of the resonator to a maximum value of 100 fs^2. In a finding surprising to a person of ordinary skill in the art, at extremely high intracavity energies, a small but constant (over a very large range of wavelengths) dispersion in the resonator of the laser can still allow pulses having a large frequency bandwidth. To this end, the dispersion need not be too high. As described below, net dispersion determines the bandwidth and, consequently, the pulse length.

Claim 12 requires a short-pulse laser arrangement comprising a resonator including a plurality of mirrors and a multiple reflection telescope for enlarging an effective length of the resonator, the plurality of mirrors including dispersive mirrors with a negative dispersion, the

resonator in operation having a positive averaged dispersion over an operating wavelength range, and the averaged dispersion of the resonator being $\leq 100\ fs^2$.

Szipocs discloses dispersive dielectric mirrors and mentions their use in short-pulse laser arrangements. As discussed, claim 12 requires a type of short-pulse laser including a multiple reflection telescope for enlarging an effective length of the resonator in a small-sized short-pulse laser arrangement.

Cho discloses a short-pulse laser arrangement including prisms to introduce a negative dispersion within the resonator (Cho, page 561, right-hand column, near top).

Reference will be made to Proctor et al., "Characterization of a Kerr-lens mode-locked Ti:sapphire laser with positive group-velocity dispersion," OPTICS LETTERS, Vol. 18, No. 19, October 1, 1993, pp. 1654-1656 and to Haus et al., "Structures for additive pulse mode locking," J. Opt. Soc. Am. B, Vol. 8, No. 10, October 1991, pp. 2068-2076, both of which are cited in the Information Disclosure Statement filed herewith.

Proctor describes experiments with Ti:Sa oscillators with net negative and net positive dispersion. Fig. 1 of Proctor illustrates measured spectra for various GDD (which is equivalent to GVD) values, while Fig. 3 of Proctor illustrates the bandwidth plotted against GDD, as predicted by theory and comprising experimental results. Proctor states that in a specific range, around GDD=0, no stable operation is possible (Proctor, page 1656, penultimate paragraph). This means that the value of GDD, according to Proctor, must be greater than a given threshold value.

It is noted that the group velocity dispersion is the group delay dispersion (GDD), as referenced in applicant's disclosure, the term "GDD" being a more recent term for describing this second order dispersion measured in fs^2.

This understanding is also reflected in Haus, which affirms that, with net positive dispersion, no large bandwidth is possible. Haus discusses a negative GDD arrangement and then the problem of positive GDD is described Haus, page 2075, left column, first full paragraph,

which provides (in relevant part) that "However, since the pulse bandwidths are less for positive GVD than for negative GVD, the minimum pulse duration performance for a given laser requires negative intracavity GVD."

Accordingly, a person of ordinary skill in the art would have concluded that, with net positive GDD, a broadband dispersion management is absolutely necessary, and for this to be made possible, prisms, such as taught by Cho, are the usual solution. Two strategies have been principally employed in trying to solve this problem: (1) to use rather large negative dispersion; or (2) to use positive dispersion with the option of temporarily shifting the dispersion to a negative value for purposes of starting operation, in particular, by moving prisms. A resonator in the positive dispersion range usually encounters problems when trying to achieve mode-locking compared with negative dispersion. Cho describes that "We initiated mode locking by slightly moving curved mirror R_2, which focuses the beam on the SBR, or by translating one of the intracavity prisms." (Cho, page 561, left column, last paragraph).

Accordingly, the focusing mirror R_2 is shifted when starting the laser to implement the conventional operation. This is problematic, however, since tests have shown that moving the curved mirror R_2 changes the focus on the SBR in an uncontrolled way so that an excessive increase of laser intensity SBR may result, with the possible consequence of destroying this important component. Thus, especially for commercial purposes, such a technique is not well suited. When moving the prisms for easier starting, the resonator can then be brought to a range of specific dispersion for a short time, namely, with large negative dispersion or with positive dispersion where the laser will be "self-starting." Thereafter, the laser may again be brought back into the range of small dispersion values to obtain broad spectra, or short pulses, respectively.

Therefore, the provision of movable prisms with the present type of short-pulse laser arrangements comprising a multiple reflection telescope is the usual technique. It also bears mentioning that a positive dispersion is necessary for the CPO effect, namely, the passing of a

long (ps) pulse in the resonator, without the possibility that, due to a high peak power, the pulse will be split into a plurality of smaller pulses.

In view of this, the fact that, at extremely high intracavity energies, a small yet constant (over a very large range of wavelength) dispersion in the resonator can still allow pulses having a large bandwidth would have been surprising to a person of ordinary skill in the art and would have been inconsistent with the general conventional view. As discussed, according to an aspect of applicant's invention as claimed in claim 12, a dispersion (GDD) in the range of about 0 leads to a broad spectrum and very short laser pulses, and this important dispersion management is possible in a great range of spectra due to the combination of using chirped mirrors having a negative dispersion, and limiting the average dispersion of the resonator to a maximum value of 100 fs^2. The cited art does not disclose or suggest a short-pulse laser arrangement comprising a resonator including a plurality of mirrors and a multiple reflection telescope for enlarging an effective length of the resonator, the plurality of mirrors including dispersive mirrors with a negative dispersion, the resonator in operation having a positive averaged dispersion over an operating wavelength range, and the averaged dispersion of the resonator being $\leq$ 100 fs^2. Further, in view of the foregoing comments, the limit of 100 fs^2 for the positive dispersion would not have been obvious to a person of ordinary skill in the art.

Claims 13-16 and 18-20 depend from claim 12 and are therefore patentably distinguishable over the cited art for at least the same reasons.

Rejection of Claim 17 under 35 U.S.C. § 103

Claim 17 is rejected under 35 U.S.C. § 103 as being obvious from Cho in view of Szipocs in view of Cunningham, et al., U.S. Patent No. 5,701,327. Reconsideration of this rejection is respectfully requested.

Cunningham does not cure the above-discussed deficiencies of Cho of Szipocs as they relate to the above-cited features of claim 12. Therefore, since claim 17 depends from claim 12, it is patentably distinguishable over the cited art for at least the same reasons.

New Claim 21

New claim 21 is added so as more fully to claim patentable aspects of applicant's invention. New claim 21 is fully supported by applicant's disclosure, see, for example, claim 12 prior to current Amendment.

Claim 21 depends from claim 12 and is therefore patentably distinguishable over the cited art for at least the same reasons.

In view of the foregoing discussion, withdrawal of the rejections and allowance of the claims of the application are respectfully requested.

THIS CORRESPONDENCE IS BEING SUBMITTED ELECTRONICALLY THROUGH THE UNITED STATES PATENT AND TRADEMARK OFFICE EFS FILING SYSTEM ON AUGUST 1, 2008

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